CITY OF ARROYO GRANDE GENERAL PLAN

1986

SAFETY & SEISMIC SAFETY ELEMENT

SAFETY AND SEISMIC SAFETY ELEMENT

SECTION 7.0 OF

THE ARROYO GRANDE
GENERAL PLAN

SAFETY AND SEISMIC SAFETY ELEMENT

FIGURES

TECHNICAL APPENDIX 7.0

I. INTRODUCTION

A. Legislative Authority, Legislative Intent

Below are Government Code Sections and legislative intent for the Safety and Seismic Safety Elements. The two Elements have been combined into a single coordinated and mandated element.

Government Code Section 65302(i): A safety element for the protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazards.

The safety element aims at reducing death, injuries, damage to property, and the economic and social dislocation resulting from fire, geologic hazards, and other public safety hazards. While the requirements for the safety element focus primarily on fires in wildland areas adjacent to urban development and on geologic hazards, it should also address other locally relevant safety issues, such as urban structural fires, hazardous materials, and defensible space.

(1980, 1982 State General Plan Guidelines, OPR)

Government Code Section 65302(f): A seismic safety element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to effects of seismically induced waves, such as tsunamis and seiches.

The seismic safety element shall also include an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves.

To the extent that a county's seismic safety element is sufficiently detailed containing appropriate policies and programs for adoption by a city, a city may adopt that portion of the county's seismic safety element that pertains to the city planning area within the county's jurisdiction, in satisfaction of this subdivision.

In adopting a county seismic safety element, a city shall follow all requirements regarding the content and adoption of general plan elements as set forth in this article and Article 6 (commencing with Section 65350) of this chapter.

Each county and city shall submit to the Division of Mines and Geology of the Department of Conservation one copy of the seismic safety element and any technical studies used for developing the seismic safety element.

The seismic safety element aims at reducing death, injuries, damage to property, and economic and social dislocation resulting from earthquakes and other geologic hazards. The seismic safety element is primarily a vehicle for identifying hazards that must be considered in planning the location, type, and density of development. It must address each of the relevant seismic and geologic hazards listed in Government Code Section 65302(f) and should address related matters, including structural hazards, possible inundation from a dam failure, and plans and programs for emergency response.

(1980, 1982 State General Plan Guidelines, OPR)

B. Purpose

This document is to serve as an official guide to potential hazards and disasters.

The Safety and Seismic Safety Element is intended to establish policy and direction within local government to minimize risk and continue emergency preparedness for disasters. Figures 7.1 and 7.2 delineate specific hazard zones and areas of concern for land use decisions.

Technical information is available in Appendix 7.0, and in City offices. Maps and data are on file in the Planning Department and Engineering Department in Arroyo Grande City Hall and Annex, and in the San Luis Obispo County Administrative Building Complex. These public records are available upon citizen request.

This Element also concerns the emergency response of City and County disaster service agencies and mutual aid programs. The City maintains a complete Emergency Plan, which is separate from this document and is for the use of the City Manager and emergency agencies. The overall purpose is to provide for the coordination of emergency operations and to protect lives and property during a state of emergency.

II. POTENTIAL HAZARDS/DISASTERS AND DISASTER RESPONSE

Incorporated seventy-five years ago in 1911, the City of Arroyo Grande has suffered economically from periodic floods, washouts, winter storms and other problems. The City was originally settled along both sides of the Arroyo Grande Creek. If this Element had existed in 1911, land use adjacent to the Creek would have been forbidden to all development, except agriculture, due to soil type, geologic hazard, and flood hazard. This Element is not designed to rewrite history or to relocate the Village, but to plan against disasters in the future, based on factual information.

The hazards which are most easily prevented by positive actions on the part of the individual or business are those relating to fire or personal safety. These are the two hazards most easily controlled by the Fire Department or prevented by the Police Department.

A. Fire Hazards

A serious annual threat to the residents of Arroyo Grande and environs is the wildland fire.

The increases in development of the North Hills area and in City population have created a two-fold problem for the Fire Department. More structures are exposed to wildfire fuel beds, and there is a greater potential for fire spread with attendant concerns relating to control where wildland fires interface with urbanized areas.

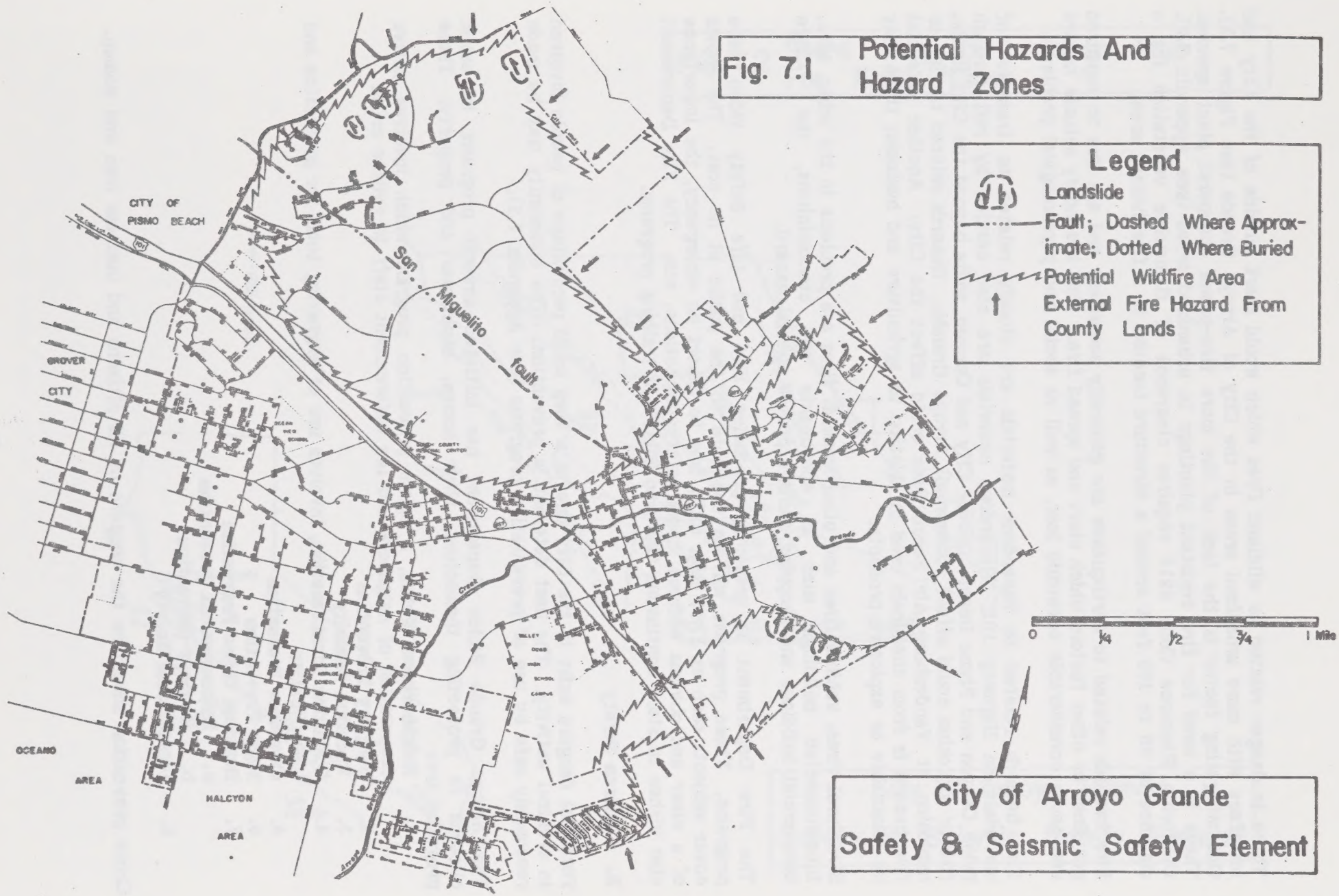
Fig. 7.1 Potential Hazards And Hazard Zones
Legend
Landslide
Fault; Dashed Where Approximate; Dotted Where Buried
Potential Wildfire Area
External Fire Hazard From County Lands
CITY OF PISMO BEACH
GROVER CITY
San Miguelito fault
OCEANO AREA
HALCYON AREA
0 1/4 1/2 3/4 1 Mile
City of Arroyo Grande
Safety & Seismic Safety Element

There is danger related to wildland fires which would start outside of the City and interface with more urbanized areas in the City of Arroyo Grande (see Figure 7.1). One mitigating factor is the lack of the more fire-prone chapparal plant species. There is a need for fire resistant plantings in urbanized areas (see Appendix 7.2). California Resource Code 4219 requires clearance of flammable vegetation for a distance of 30 to 100 feet around a structure located in a fire hazard area.

Fire hazards related to earthquakes are generally secondary and are due to ruptured gas lines or other factors which start and spread fire. This secondary seismic hazard can cause considerable economic loss, as well as social and psychological problems.

Fire hazards related to hazardous materials are closely related to transport of materials on Highway 101. Hazardous materials are also carried by rail through Price Canyon and Pismo Beach, Grover City and Oceano, while beyond the City limits, fire or explosion could affect (downwind) Arroyo Grande. Hazards related to fire or explosion at Vandenburg Air Force Base could affect the City. Another potential fire hazard is from chemicals used in relation to agriculture and business; these may be flammable or explosive products.

Structural fires, vehicle fires and other general fires are problems in the urban area. Interconnected buildings such as apartments and condominiums, the Village commercial buildings and shopping centers pose a special hazard.

The Fire Department is presently producing Fire and Life Safety video tape programs. These programs will be available to the public at no cost. The topics cover subjects such as First Aid, CPR, how to report an emergency, the importance of a clear and obvious address, home safety inspections, etc. The Fire Department also wishes to start continuous CPR and First Aid training programs.

B. Citizen Safety

Potential dangers exist in the City due to a very small percentage of people involved in criminal activity. The best deterent is prevention. The community may be made reasonably safe by use of preventative programs (see Appendix 7.2).

The Arroyo Grande Police Department has initiated several programs to assist citizens in protecting themselves, their homes, businesses and property. These programs are:

1. **Neighborhood Watch,** a crime prevention program which involves active cooperation of neighbors and law enforcement staff to reduce crime
2. **Burglary Prevention**
3. **Vacation Security**
4. **Operation Identification,** involves use of engraving tools for protection and identification
5. **Consumer Protection**
6. **Rape Prevention**
7. **Business Crime Prevention**
   a. **Embezzlement prevention**
   b. **Robbery prevention**
8. **Recreational Safety**

Crime prevention should be the concern of all citizens and business men and women.

Fig. 7.2 State Map & Location Map For Fault Lines

City of Arroyo Grande
Safety & Seismic Safety Element

C. Noise Hazards

In general, Arroyo Grande and San Luis Obispo County may be considered relatively quiet environments. The major noise sources are few and of limited impact.

The most significant source of noise is traffic noise, particularly Highway 101. With the growing amount of traffic on City streets as documented by the Circulation Element (Figure 3.2, Traffic Volume), traffic noise will be an increasing problem to residents beyond the Highway 101 corridor, also. The expected increase in the number of noise sources (traffic) will affect the total noise level for the City.

The major change in neighborhood noise has been due to changes in technology since the writing of the Noise Element, 1976. New tools (leaf blowers), wider use of tools (chain saws, kitchen machines, spa and pool motors), increased use of amplifiers and sound magnifiers (radio "boxes"), electric musical instruments, motorcycles and heavy trucks, vehicular sound systems, and computerized printers have raised the noise levels in and around homes and neighborhoods.

For information on technical data, noise contours, psychological and physical effects of excessive or unexpected noise, see the Noise Element 8.0.

The Legislature, recognizing the steady escalation of outdoor noise as a significant environmental hazard, requires a separate Noise Element. In order to have any control over noise, it is necessary to consider noise in the planning process. The impact of noise must be included in the General Plan and will aid in determination of appropriate land use regulation, especially in transportation corridors.

As is true of most environmental hazards, preventing the hazard or reducing the costs of the future hazards is easier and less expensive than changing the existing hazards (see Noise Element).

D. Seismic Hazards

Arroyo Grande is in a seismically active area, the major active fault being the San Andreas Fault and a secondary active fault, the Nacimiento Fault. The San Miguelito Fault crosses Arroyo Grande approximately parallel to James Way (see Figure 7.2). Other faults in the area are East Huasna and West Huasna, Edna and Edna Extended, San Juan, La Panza and Indian Knob. More research is needed to determine the activity/inactivity status of these latter seven faults. The offshore Hosgri Fault is seismically active; however, available marine geophysical data indicate future land surface rupture is improbable.

When a fault is defined as active, it does not mean that the entire fault is active, but that some portions have had "symptoms" of movement.

1. Earthquakes

Earthquakes are the result of energy release from forces generated within the earth that affect the surface. The energy from these forces is stored in the rocks in a variety of ways. When this energy is suddenly released, an earthquake is the result. The point on the surface directly above the occurrence is referred to as the epicenter.

Currently, most seismologists accept the triple theories of continental drift, ocean floor spreading, and plate tectonics. Evidence indicates that the continents, and indeed, the oceans, rather than being anchored firmly in place,

are instead residing on huge masses called plates. Because of this unstable condition, the continents drift, and are in constant, but extremely slow motion.

Here in California the concern is with the aptly named Pacific Plate. Although the major part of the North American continent rests on a plate named the North American Plate, a sizable part of coastal California is on the Pacific Plate. This Plate is wedging itself beneath the North American Plate at a steep angle. The land mass responds to this pressure by buckling, breaking, and fracturing in the earth's crust, creating earthquake faults. While some may be fairly shallow, others have been determined to be as much as 30 miles deep. San Luis Obispo County is located on the northwesterly-moving Pacific Plate (see Figure 7.3).

During millions of years, a long line of breakage and fractures developed that is called the San Andreas Fault, the most infamous in the world. The San Andreas Fault from its appearance onshore in California trends northwest/southeast. The San Andreas Fault forms an interwoven strand headed northwest from the Sea of Cortez (east of Baja California), through the Coachella Valley to San Bernadino. Near San Bernadino, it fractures and trends in a more westerly-easterly direction across the San Gabriel mountains and the Tehachipi mountains to Fort Tejon, site of the infamous 1857 earthquake. From this point north to San Francisco, the San Andreas remains on land, trending in a northwest/southeast direction. At San Francisco, the fault enters the Pacific Ocean. This onshore/offshore pattern continues until the fault is south of Eureka (see Figure 7.3). The land to the west of the San Andreas Fault is, and has been, moving northwesterly on the Pacific Plate for millions of years, at an **average rate** of approximately two inches a year.

The United States Geological Survey (USGS) has predicted a quake near Parkfield at the northeast corner of San Luis Obispo County, along the San Andreas Fault. The most likely time is **January, 1988**, with a 95% probability of a quake within **five years** prior to or following that date. Likelihood of a severe earthquake is substantial enough to be considered in setting building standards. The Arroyo Grande area is most likely to be affected and damaged due to an earthquake related to the San Andreas Fault.

The USGS monitors areas of potential earthquakes by use of seismographs, laser survey methods, earth tiltmeters, radon detection devices and other equipment. Unlike some other nations, there is no uniform system of notification and prediction in this country.

Damage to Arroyo Grande, due to seismic activity along the San Andreas Fault could be caused through ground shaking, ground rupture, ground failure, liquefaction, land sliding, lurch cracking or lateral spreading. Fire and flood are secondary dangers directly related to earthquakes. Of this list of primary dangers, ground shaking represents the greatest hazard. The next greatest hazard is the secondary danger related to fire.

Some structures are safer than others; wood frame buildings are relatively safe. Low-rise, reinforced concrete and stucco buildings are resistant to damage. Utility structures and lines can be damaged or destroyed by ground shaking. Utility lines, storm drains, roadways, culverts and water lines are in danger of breakage (see Public Facilities Appendix 9.0). The structures which are most susceptible to damage are those inadequately braced buildings and buildings of unreinforced masonry. Mobile homes are particularly susceptible to earthquake damage, often lacking all semblance of structural foundation or tiedown.

Manufactured homes, by contrast, are required to use standardized foundations. The City, homeowners and businesses are likely to suffer economic repercussions resulting from a major earthquake (Richter magnitude 6.0 or higher).

A general rule is, the farther from the epicenter, the safer. However, there is increased knowledge that certain types of sites tend to increase the hazards. Marshland, or any previous wetland, has the potential for longer shaking (and resulting structural damage) and the potential for liquifaction. When soil and debris layers change from a solid to a liquid, structures on top slide, slump and can even sink.

Numbers relating to earthquake magnitudes do not compute in the usual arithmatic manner; that is, 6.0 is not one more than 5.0. Earthquake magnitude is calculated logarithmically; that is, a magnitude 6.0 earthquake releases **ten times more** energy than a magnitude 5.0 earthquake.

2. Tsunamis

Tsunamis are episodal waves resulting from earthquakes, either submarine or land quakes, or volcanic eruptions. Grover City, Oceano and Pismo Beach are the areas most likely to be affected; Arroyo Grande Creek and areas adjacent could be affected, with a combination of high tide, winter storm and tsunami episodal wave. The probability of tsunami damage is very small in the Arroyo Grande Creek area of the City, as the elevation average is 75 feet above sea level (west of Highway 101).

According to the National Oceanic and Atmospheric Agency (NOAA), the world's oceans are due to rise each coming decade; tsunami damage could become more of a danger in the 21st century.

Based on quantitative data, a Tsunami Watch was announced after the Mexico City earthquake, September, 1985. This was preliminary to the need to announce a Tsunami Warning. Both a Tsunami Watch and Warning are part of the State Warning Control System which serves to alert affected areas.

3. Seismically Induced Bridge or Overcrossing Failure

A large earthquake or series of quakes can affect and/or damage bridges and overcrossings, especially those built to pre-1974 standards. This is of particular concern to emergency agencies that must respond to fire and other disasters within minutes. Structural integrity should be investigated; appropriate agencies are Caltrans for Highways 101 and 227, and the City Engineer for City streets designated as truck routes.

If bridges are damaged, utility lines attached to the bridge structure will likewise be damaged. Lines include gas, sewer and water; severage of sewer lines could present a serious health hazard.

4. Seismically Induced Dam Failure

Based on studies for the 1975 County Seismic Safety Element, "surface rupture along an active fault through a dam structure itself is not a **significant** hazard." The ability of major dams to withstand ground shaking in a large magnitude earthquake or a series of quakes has **not** been determined. Two branches of the West Huasna fault could affect Lopez Lake Dam; one branch is directly west of the dam face, the other underlies the reservoir (see Fig. 7.1).

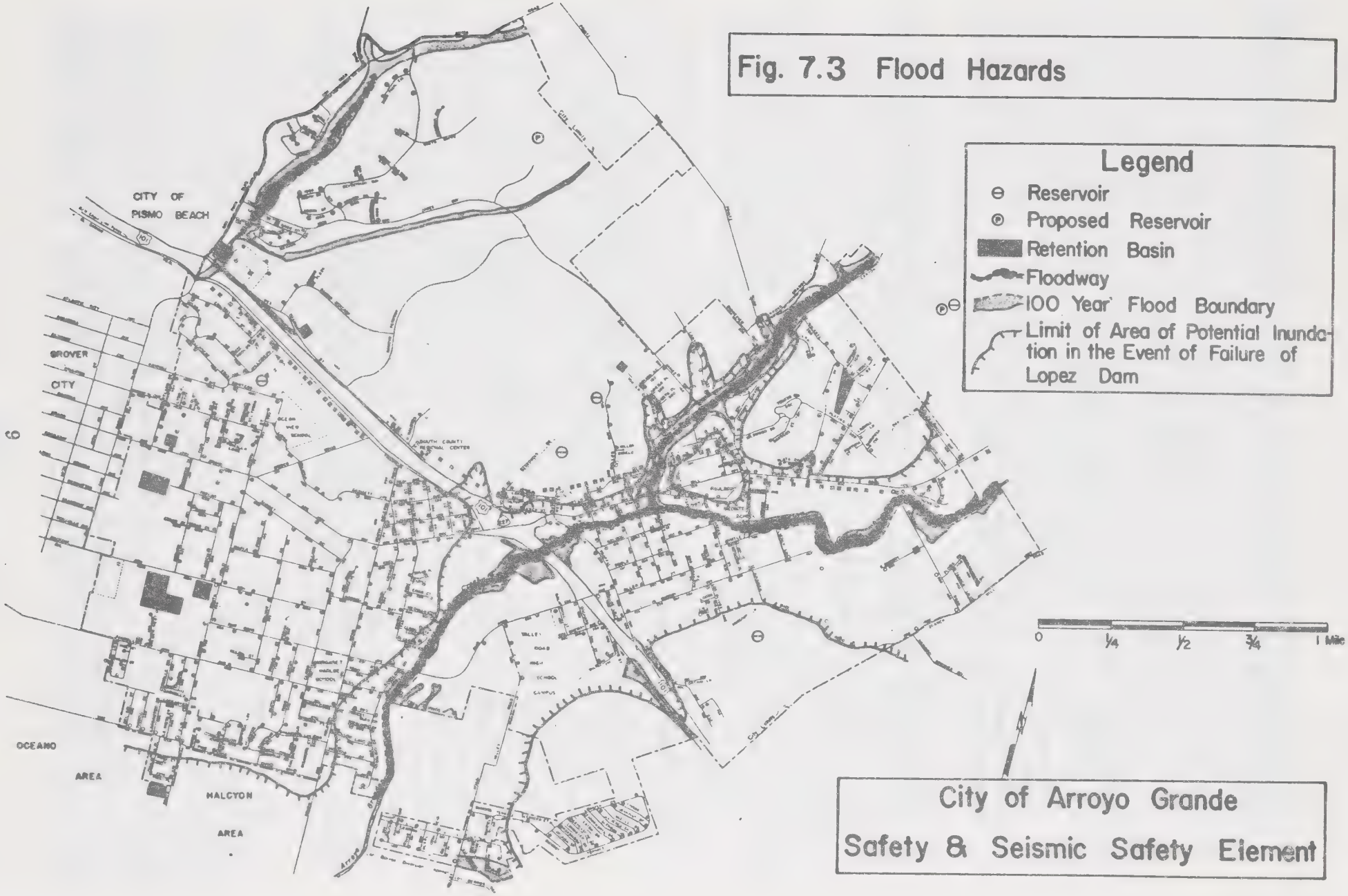
Fig. 7.3 Flood Hazards
Legend
Reservoir
Proposed Reservoir
Retention Basin
Floodway
100 Year Flood Boundary
Limit of Area of Potential Inundation in the Event of Failure of Lopez Dam
CITY OF PISMO BEACH
GROVER CITY
OCEANO AREA
HALCYON AREA
0 1/4 1/2 3/4 1 Mile
City of Arroyo Grande
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Lopez Dam is located in Lopez Canyon, eight miles east of Arroyo Grande. The earth dam was completed in January, 1969, and has the capacity to store 52,000 acre feet of water.

The State Department of Dam Safety investigated Lopez Dam (and others) in the early 1980's, and Lopez Dam was deemed to be seismically safe at that time. No quantitative data relating to the Richter scale was made available.

Overtopping, as a result of a massive landslide into Lopez Reservoir when full, is possible. While occasional seismically-induced landsliding may occur into Lopez Reservoir, the volume is large enough to accommodate most slides with minimum downstream risk and only moderate damage to shore facilities. Seiches, water movement resulting from earthquakes, could cause damage. Seiches can last from minutes to hours and can affect lakes, ponds, drainage ponds, pools, hot tubs and reservoirs.

More research remains to be done to quantify the above; new studies by the County should be added to this section as they are completed. Investigations are necessary prior to statements regarding safety of a particular structure.

5. Seismically Induced Tank Failure

Rupture of water storage tanks due to seismic activity is a possible, but not probable, hazard. Figure 7.3 notes the location of these storage tanks, but does not locate the downhill path of water in case of tank failure or rupture. Tanks are maintained by the Public Works Department and are partially underground.

6. Seismically Induced Pipeline Rupture

A number of major pipelines (oil, gas and water) cross Arroyo Grande; these major lines are susceptible to rupture due to seismic activity. Route descriptions are contained in Appendix 7.11 for each type of major pipeline.

The pipelines which contain flammable liquids are the most dangerous in case of rupture; the natural gas and water pipelines are somewhat less dangerous. Pressures within the pipelines are approximately 400 pounds per cubic foot.

If these pipelines were to rupture due to earth shaking, earth movement related to seismic activity, the greatest danger would be to "captive" groups, in particular, school children at Margaret Harloe School and the Arroyo Grande High School, as well as patients at Arroyo Grande Community Hospital. Coordination between school, hospital and City emergency staffs are needed on a continuing basis. Emergency response may involve evacuation of neighborhoods or may be after the fact rescue responses.

Smaller pipelines which serve local residences and business are located throughout the City.

E. Potential Flood

Flood hazards are considered in two categories; natural flooding and dam inundation. Natural flooding results from severe winter storms, which produce excessive runoff and drainage problems. Dam inundation refers to structural failure (partial or total) of Lopez Dam, which would flood low-lying farmlands and/or developed areas (see Figure 7.3).

The potential and extent of flooding in Arroyo Grande is mapped by the Federal Emergency Management Agency (FEMA). Areas adjacent to Arroyo Grande Creek, Tally Ho Creek and drainages in the North Hills area have designated flood hazards (see Figure 7.2). The City has adopted the Federal Flood Insurance Map and FEMA requirements for floodplain zoning (see Articles 36 and 37 of the Zoning Ordinance).

The Federal Emergency Management Agency (FEMA) provides cities and counties with maps which delineate the floodways (in which no development may occur) and the flood zone with boundaries which mark (a) the 100-year flood, and (b) the 500-year flood. The boundaries are indicative of floods which occur periodically but irregularly. A 100-year flood boundary line shows flood inundation which could occur once every 100 years or which may occur in any year with a 100:1 probability.

The aim of FEMA in prohibiting any development in floodways is to (a) protect life and property, (b) restrict the number of people affected by future disasters, and (c) reduce post-disaster expenses.

The following discussion defines the flood hazard areas and the relative zoning and building requirements. The 100-year floodplain is the area of inundation from a flood which has a one percent (1%) statistical probability of occurring in any given year. In this area, building floor elevations must be a minimum of 12 inches above the 100-year floodplain elevation. The floodway is a narrower area within the floodplain. The floodway includes the adjacent land area that must be reserved to discharge the 100-year flood without cumulatively increasing the water surface elevation more than one foot. Building and structures that would obstruct flood flow or be subject to flood damage are prohibited within the floodway.

The ALERT automated flood warning system is used by San Luis Obispo County. This system (Automated Local Evaluation in Real Time) has been placed in the Las Pilitas fire burn area (1985) and will be expanded to other areas prone to flooding. ALERT produces a flash flood warning and a flood alert depending on total rainfall per hour and per day. The National Weather Service provides the equipment, while the County maintains the equipment and administers the program. Part of the system is a direct tie-in by radio and telephone to a 24-hour computerized weather monitoring system.

Excessive runoff presents problems of both quality and quantity. The quality of the receiving waters is affected by the contents of the runoff, in particular, wastes such as automobile grease and oil. The quantity of the runoff is determined by precipitation factors; storm intensity and duration, as well as shape, size and slope of the catchment area and permeability of the soil.

The City has worked to alleviate severe drainage problems throughout the City, between 1975 and 1985. Drainage improvements have taken place in the North Hills area, the Oro and Stagecoach area, Brisco Road area, Sunrise Terrace, at Strother Park and the area just west of Strother Park, at Town and Country Shopping Center and at the Soto Sports Complex.

Soto Sports Complex is currently (1986) undergoing design revision which will provide storm water drainage, provide a larger amount of storm water storage, allow for better recharge and restoration of the ground water basin and provide continued and expanded use of the Sports Complex for organized sports and non-directed recreation. Also, water in these drainage basins will be used to irrigate the entire Soto Sports Complex.

Dam inundation due to structural failure of Lopez Dam is very unlikely; however, the possibility needs to be addressed. If the structure was to fail, waters held by the

dam would be released and would flow through the area of historical flooding, the Arroyo Grande Valley, to the ocean. Inundation areas are detailed in Figure 7.3 (based on 1974 mapping, San Luis Obispo County Engineering).

F. Potential Drainage Problems

Specific areas are designated as drainage ponds, for use during and following winter storms. These are shown on page 3, Figure 7.1; location of new drainage ponds must be added. At the Soto Sports Complex, three fields are dual purpose; temporary drainage ponds when needed, otherwise used for sports fields. All drainage pond areas must remain in open space use and are not to be developed.

A drainage problem remains on Tally Ho Creek. Solutions include (1) control of waters by coordination between the City and the County of San Luis Obispo, (2) cessation of periodic floods through assessment district commitment by property owners, or (3) purchase of the Tally Ho floodway by the City with dredging to the 100-year flood level.

Drainage problems exist south and east of the high school; when this area is developed, an assessment district could be formed to resolve the problem. A drainage problem remains on agricultural lands, south of the Arroyo Grande Creek and east of the Village. Possible solutions include an assessment district formation or development, neither of which are probable at this time.

G. Landslide and Soil Instability

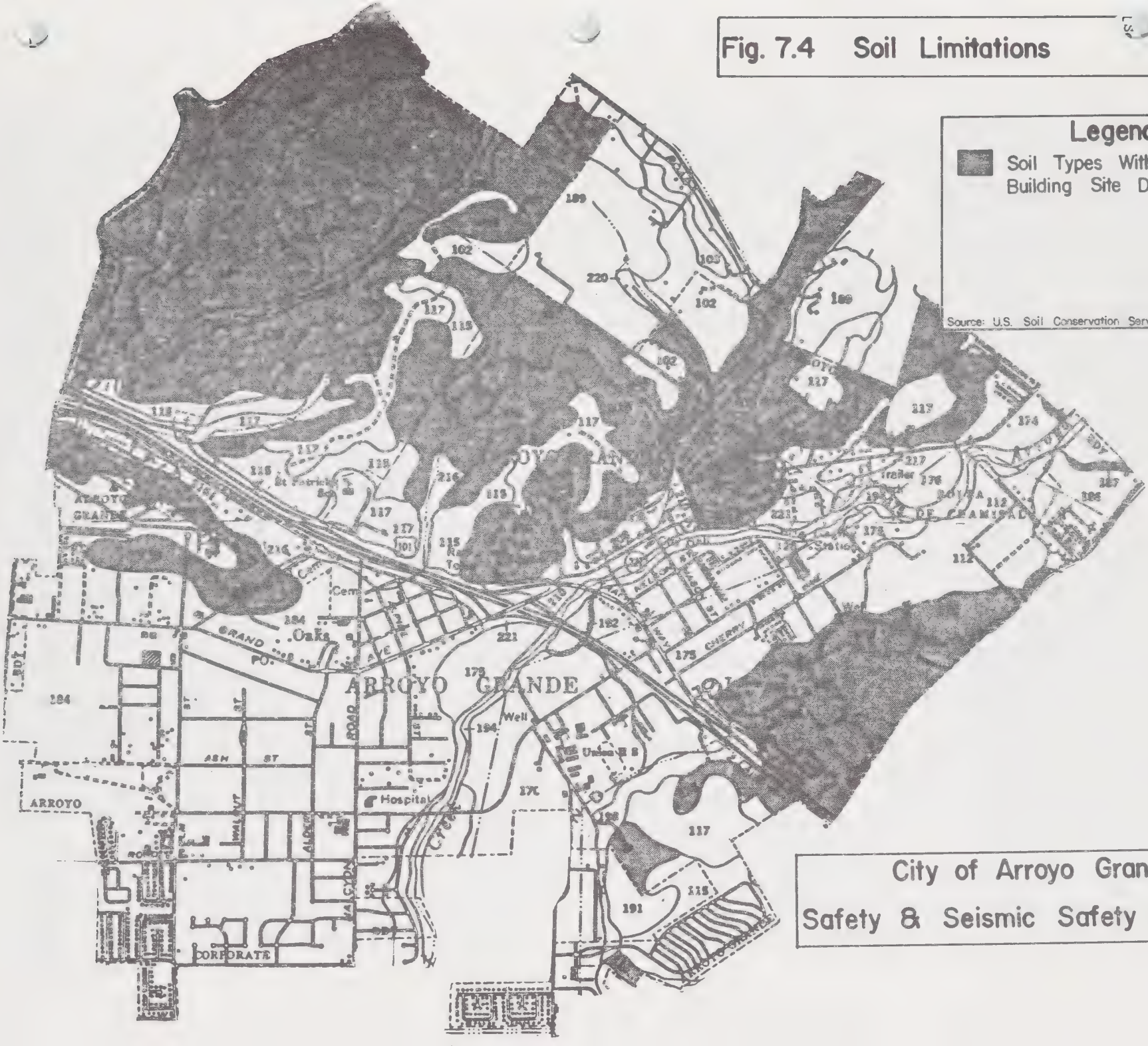
Landslides and other soil instability present an avoidable hazard in steep areas and areas of historic slippage. Land use decisions require restriction of such areas for open space and conservation uses. The potential for disaster is increased in times of flood, heavy winter storms and seismic activity. A soils engineering report by a civil engineer is required for subdivisions. Data is to include existing soils, grading, mitigating measures where necessary, plus adequacy of development opinions and recommendations.

Areas adjacent to creek beds are also potential areas of instability and may require professional assessment to determine stability/instability, or the possibility of liquifaction and collapse (see Figure 7.1, Potential Hazards and Hazard Zones).

Liquifaction of roads has been established for South County by the Earthquake Emergency Planning at Diablo Canyon (see Appendix 7.9). Liquifaction is a geologic term which denotes the change from a solid to a liquid-like form, usually as the result of seismic activity or a series of earthquakes.

The U.S. Department of Agriculture Soil Conservation Service (SCS) has mapped soils in Arroyo Grande and listed soil types which pose limitations to building site development. Particular soil types have characteristics that may increase the construction and maintenance costs of development. These soil characteristics may include a high water table, shallow depth to the bedrock, shrink-swell properties, low soil strength, high organic matter and stone content, or steep slopes. Figure 7.4 maps soil types listed by the SCS as having severe limitations on building site development. This map is only informational, the soil limitations can be mitigated. The City requires soil engineering reports and issues grading permits for development, and site specific problems are addressed by the City Engineer. Specific land use regulations and geologic reports are required in landslide and other hazardous soil areas (see page 17, Section B-Land Use Regulations).

Fig. 7.4 Soil Limitations



City of Arroyo Grande

Safety & Seismic Safety Element

H. Hazardous Materials

The need to plan for problems related to hazardous materials is apparent. The public has become more concerned about these problems and more emphatic in its demands to see positive actions taken to reduce hazards.

Emergency response agencies are not able to keep daily data on types and amounts of hazardous materials used, stored in and transported through the community. A transportation risk assessment can serve as a first step toward developing the required information. Kansas State University has developed a Risk Assessment Model. This model offers a reasonable means to initiate the information gathering process and evaluate the risks at the local level. Use or adaptation of this model by the Police Department could provide guidance for prevention and response programs.

Chemical hazards include fertilizers, insecticides, pesticides, gasoline, gases, explosives and other toxic and hazardous materials. Hazards can result from transport, storage and use of specific substances. Hazards can exist due to uncontrolled air drift, water travel by surface or ground water, or contamination of land. Factors involved include chemical composition, amount, and form (solid, liquid or gas) (see Appendix 7.7).

Chemical hazards can produce secondary hazards, primarily fire and/or explosions. Closing of a highway or evacuation of a district may be necessary due to chemical hazard. Multi-unit forces may be called due to size or extent of chemical hazard involved. The City Fire Department, Caltrans Emergency Team, and other agencies which are part of the mutual aid agreement may be involved in hazardous materials cleanup. Underground storage of hazardous materials in monitored double-tank containers is the responsibility of San Luis Obispo County.

I. Radiation

A brief statement regarding radiation hazards is included due to the presence of the Diablo Canyon Nuclear Power Plant in San Luis Obispo County. The potential for a hazardous situation arises from the presence of highly radioactive nuclear fuel within the County. This potential hazard is recognized by PG&E, government agencies and citizens.

It must be assumed that an accidental release of harmful levels of radiation is possible, although the probability of such an accident is low. Planning for such an accident is prudent and necessary for public safety (see Appendix 7.9 for the Emergency Response Plan, 1985-86, from the San Luis Obispo County Office of Emergency Services).

Diablo Canyon Nuclear Power Plant is located approximately 15 miles northwest of Arroyo Grande, and contains two power generating units. The plant, operated by Pacific Gas and Electric Company (PG&E), uses uranium dioxide (UO_2). This fuel, the slightly enriched uranium dioxide in its irridated state, is of very low radioactivity. However, after being in the core during operation of the reactor, the fuel becomes extremely radioactive from the fission by-products. These by-products present a potential hazard. An accident could affect the largest number of people for the longest time following a disaster.

The principal deterrent to an accident is prevention. Prevention includes design, construction, operation, safety measures and maintenance of the reactor system. Should any part of the reactor system fail, protective systems should be automatically activated. The probability of an emergency is extremely small; however,

the possibility for the greatest harm exists.

J. Other Potential Emergencies

Other disasters may occur which would influence the future of the City. The General Plan is not designed to address these at present. Perhaps when the 5-year review is begun, one or more will be addressed, such as financial reverse, breakdown of present institutions, national or global epidemic, war, nuclear accident, nuclear winter, greenhouse effect, space war, terrorism, information control, genetic disaster, famine, changed patterns of agriculture, "natural" disasters (other than earthquakes), water problems, salt water intrusion, groundwater contamination, and/or toxics in air, soil or water supply.

III. PLANNING, RESPONSE AND REGULATION

A. Disaster Planning and Emergency Response

The City and County provide a defense against major disasters through a mutual aid agreement. Emergency agencies support and aid one another through this agreement. Sound, local and statewide planning and resource inventories should provide improved management of major disasters.

Mutual aid agreements among fire agencies provide adequate emergency assistance during the initial stages of a local (fire) situation. Mutual aid has proven to be efficient and economical. The 1985 Las Pilitas fire showed dramatically the positive use of mutual aid agreements, when forces from all over the State centered on the disaster. Continued improvement is needed to provide for use of a common emergency communication channel and system by the various agencies.

Cities and counties are obligated by the Emergency Services Act to prepare and maintain **emergency plans**. Emergency plan testing should be conducted once every year and be coordinated with city, hospital, school and emergency response staffs. Police departments and the sheriffs' departments are part of a mutual aid agreement and work cooperatively in case of emergency.

Emergency routes are shown on Figure 7.5, and would be controlled by police, California Highway Patrol (CHP) and/or County sheriffs in case of accident, emergency or the need to evacuate a specific area. Response corridors are defined as primary routes along which emergency vehicles travel when responding to an emergency. Response corridors are usually major or minor arterial streets which offer sufficient width for fire vehicles (see Circulation Element 3.9). Roads chosen as response routes usually follow the most direct paths to the various parts of the community; because these streets are heavily used, problems can arise due to traffic congestion.

Being prepared is the key to survival in any emergency situation. Households and businesses need to prepare for a 72-hour period of self-sufficiency. Each family should have enough emergency supplies stored away to last on its own for 72 hours. That gives local, state and federal agencies, as well as private agencies like the Red Cross, time to organize and respond with assistance. Particularly in case of earthquake, families and neighborhoods may be isolated and unable to contact others.

Information for groups and individuals is available from the San Luis Obispo Chapter of the American Red Cross.

Emergency response directives are included in the **City Emergency Plan.** The Emergency Plan would be used in case of a major disaster from earthquakes and related seismic emergencies. Close coordination between Police and Fire Departments is necessary, as well as other agencies and the San Luis Obispo County Office of Emergency Services. There is no emergency response related to **noise**; all planning is directed to land use restrictions adjacent to noise sources.

The **State Joint Committee of Seismic Safety recommends** that cities:

1. Take all practical measures to reduce present high hazards levels;
2. Avoid creation of further hazards. Use planning, building and development principles and practices which avoid hazards and take seismic safety seriously.

These recommendations demand comprehensive and long-term commitment. Land use decisions are fundamental to seismic safety.

There is no specific emergency plan related to seismically induced bridge or overcrossing failure; prevention is the best plan. Caltrans has a statewide program to upgrade overcrossings, etc., to current stringent seismic codes through cabling and structural reinforcement. Those structures which are most endangered have first priority for State (STIP) funding. Relating to local streets and bridges, the City Engineer will investigate and upgrade as necessary, with designated truck routes receiving the first priority for funding.

The **State Warning Control System** includes both Tsunami Watch and Tsunami Warning, which alert areas of potential danger.

The National Weather Service provides the automated flood warning system (ALERT) equipment which the San Luis Obispo County operates. This provides both flood warning and flood alert to emergency agencies.

There is no emergency response directed specifically to landslide, subsidence or liquifaction.

Hazardous materials are included in the City Emergency Plan which has specific directions for emergency staff. Cooperation with other agencies is essential, including OES, Caltrans, State Water Quality Control Board, etc., as well as local fire and police departments. Materials which are hazardous due to their explosive qualities are handled and/or removed by the San Luis Obispo County Bomb Task Force.

The San Luis Obispo County **Office of Emergency Services** has produced and distributed to each school, business and household the Diablo Canyon Power Plant Emergency Response Plan booklet (1985-86). The Fire Department and Police Department provide continual updating of training for staff people, for emergency response, and also coordinate with other agencies.

Lucia Mar Unified School District has adopted an emergency plan and has tested it each year since 1982, including school evacuation via school buses with police escorts (see Appendix 7.10). Information for personal and family response to emergencies is located in the front of every telephone book. Information is provided by Police and Fire Departments and the Red Cross. Video tapes of fire and public safety are free and available for groups or families. Needed are informational radio spots which are acceptable to the general public.

The Nuclear Regulatory Commission **(NRC)** requires an annual drill for trained

medical personnel. Radiation contamination levels that might be sustained in a nuclear plant accident are considered by specialists to be very low, with little risk to either victim or medical personnel. However, medical personnel must be trained in dealing with radiation. Annual refresher courses are given for staff personnel at French Hospital in San Luis Obispo and San Luis Ambulance Service. As with other regional emergencies, this involves cooperation among agencies.

Disaster planning or crisis management is necessary and important. Organizations that are involved in crisis management and practice annually or quarterly recover from a crisis 2 to 3 times faster than organizations that are not involved. The question is not, "Will a disaster occur?", but, "When?" and "How many will be affected?". The more groups involved in disaster planning and practice, especially citizens' groups, the shorter and less expensive the recovery period will be, as people mobilize rather than remain stunned and immobilized. Needed are more citizen education and citizen participation.

B. Land Use Regulations

Hazards and hazardous conditions shall be prevented wherever possible. Use of local, state and federal land use regulations in Arroyo Grande can have positive effects on safety for residents, businesses and homes. Following are the general statements regarding land use regulations; specifics are located in the City building codes and zoning ordinances.

1. **Fire:** All new development must meet fire safety building codes and inspection. Needed are further preventative development regulations regarding sprinklers, roofing, fire resistant landscaping and retrofitting.

2. **Citizen Safety:** Needed are specifics related to visual surveillance and lighting in commercial development.

3. **Noise:** All new development in noise hazard areas must meet (California) Title 25 Sound and Insulation Requirements. Needed are noise ordinances to mitigate specific nuisances in the City.

4. **Seismic:** All new development must meet seismic safety building codes and inspection. Needed are full utilization of Construction Process (83-05), criteria for existing buildings, Safety Study and Recommendations for existing masonry buildings and educational programs.

5. **Flood:** All new development must meet flood safety building codes and inspection. No development may occur in federal floodway areas; development in Flood Zone A or B may occur only with flood proofing per building department requirements (see Figure 7.3).

6. **Landslide:** No development may occur in areas of landslide potential (see Figure 7.1). Engineering geology reports may be required in areas of historic or potential landslides, liquifaction or subsidence per building department requirements.

7. **Hazardous Materials:** All underground storage, new and existing, must meet California Health and Safety Code double tank and monitoring requirements.

Land use regulations and requirements are essential to prevent disasters. The purpose of stringent regulation of hazard areas is to prevent damage to life and

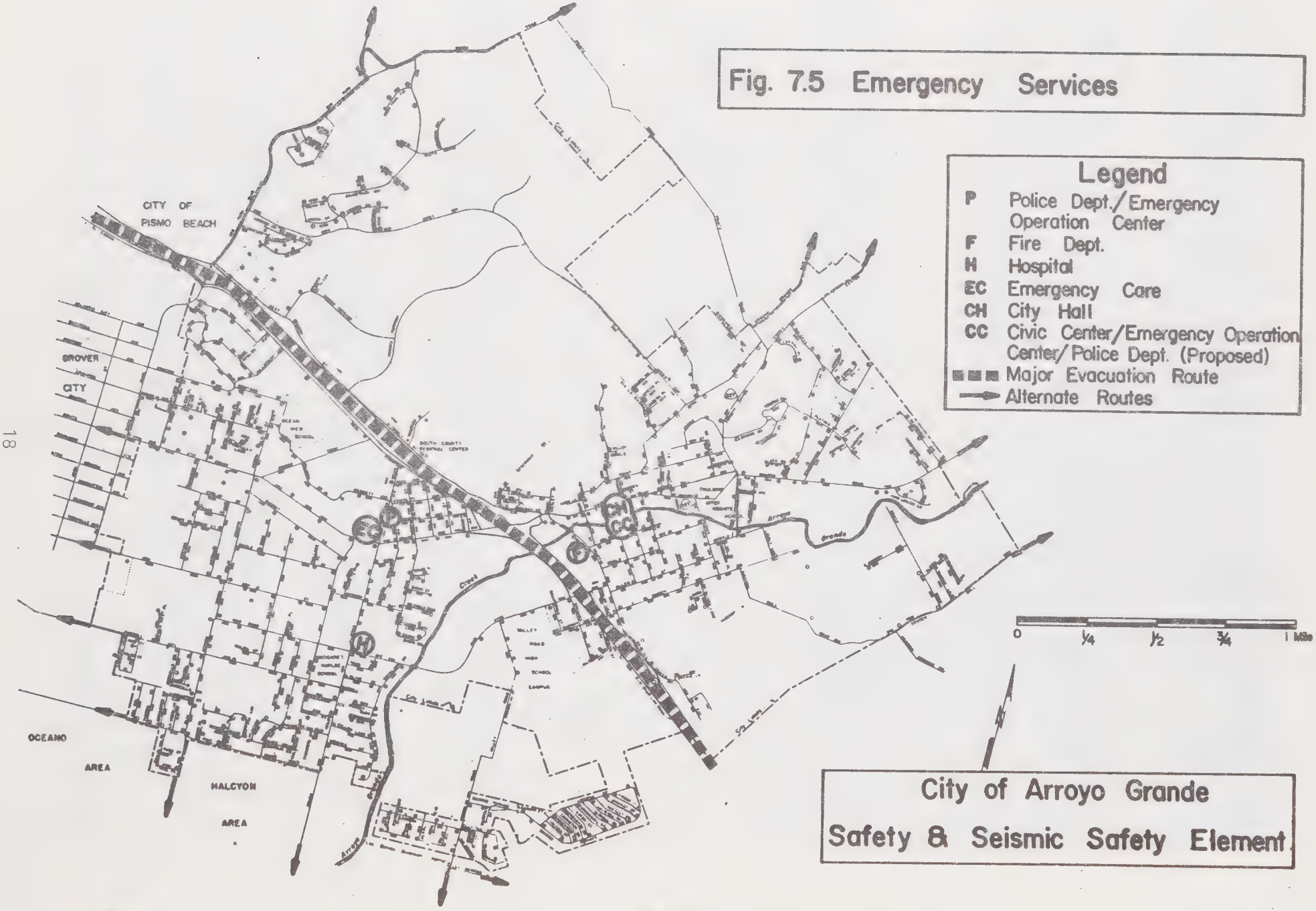


Fig. 7.5 Emergency Services

property and to reduce the number of injuries and/or deaths in emergency situations whenever possible. Both public and private costs related to hazard area emergencies can be reduced through regulation.

IV. GOALS, POLICIES AND PROGRAMS

GOAL A: PROTECT LIFE AND PROPERTY

Policy A: Provide staff and organization to maintain safety in the City.

Program 1: Maintain Police Department and staff, and 24-hour response to emergency.

Program 2: Maintain Fire Department, Chief, volunteer staff and 24-hour response to emergency.

Policy B: Provide equipment to maintain safety in the City.

Program 1: Maintain, repair and replace police vehicles.

Program 2: Maintain, repair and replace fire vehicles.

Program 3: Maintain communications systems.

Program 4: Maintain records and record keeping, including computer and computerized records.

GOAL B: MINIMIZE POTENTIAL DISASTERS/HAZARDS FROM OCCURRING

Policy A: Provide preventative measures to avoid potential hazards.

Program 1: Require the use of fire safety materials and practices in all new development.

Program 2: Require materials and practices to stabilize buildings for seismic safety.

Program 3: Retrofit existing buildings for fire and seismic safety standards.

Policy B: Maintain City inspection and review programs.

Program 1: Maintain fire safety building and inspection programs.

Program 2: Maintain seismic safety building and inspection programs.

Program 3: Maintain flood safety permit and inspection programs.

Program 4: Review new commercial development for visual surveillance and lighting.

Policy C: Restrict development in known hazard areas.

Program 1: Prohibit building within the identified floodway.

Program 2: Require flood safety practices and materials in the floodplain.

Program 3: Restrict development in known landslide areas.

Policy D: Coordinate with Federal, State and County agencies to minimize hazard risks.

Program 1: Continue dam structure maintenance and inspection by the County.

Program 2: Conform to Federal and State laws regarding hazard areas.

Program 3: Support and coordinate with County on emergency response plans.

GOAL C: PREPARE STAFF AND CITIZENS FOR ACTIONS IN A STATE OF EMERGENCY

Policy A: Coordinate with other emergency service agencies.

Program 1: Continue mutual aid program with the County, other cities and related state and local agencies.

Policy B: Maintain staff training, maintain and update information.

Program 1: Continue police safety training for staff.

Program 2: Continue fire safety training for staff and volunteers.

Program 3: Continue staff training program for hazardous material procedures.

Program 4: Continue staff training program for radiation preparedness.

Program 5: Continue staff training program for communication systems.

Program 6: Continue staff training program for computer systems.

Policy C: Prepare for emergency situations which would affect the City.

Program 1: Continue simulated emergency exercise annually. Include hospital, school and City staffs in exercise.

Program 2: Update the City Emergency Plan annually.

Program 3: Inform the public through radio spots, news.

Policy D: Inform the public of emergency measures and practices.

Program 1: Continue public education programs for fire prevention, etc.

Program 2: Initiate new education programs, utilizing video tapes.

Program 3: Rely on telephone company to continue to provide emergency response information in annual telephone book.

Program 4: Rely on emergency services to publish and distribute emergency response booklets as required by Federal law.

GOAL D: REDUCE THE PRIVATE AND PUBLIC COSTS RELATED TO HAZARD AREA EMERGENCIES

Policy A: Development should be restricted in hazard areas.

Program 1: Prohibit building within the floodways (creeks).

Program 2: Prohibit development in landslide areas.

Program 3: Maintain fire safety building and inspection program.

Program 4: Maintain seismic safety building and inspection program.

Program 5: Maintain flood safety building and inspection program.

Program 6: Continue dam structure maintenance and inspection by the County.

Program 7: Conform to State and Federal laws regarding hazard areas.

V. PROJECT IMPLEMENTATION
(1985 - 1990)

ONGOING PROJECTS	SPECIFIC PROJECTS
Fire Prevention: Fire safety and inspection.	**Fire Prevention:** Establish ordinances which are preventative. 1. Automatic sprinklers 2. Roof material regulations 3. Fire resistant landscaping in wildfire areas. 4. Initiate criteria for wildfire areas. 5. Establish requirements for existing hotels, motels and businesses regarding fire prevention.
Fire Safety Education: Continue fire safety training for staff and volunteers.	**Fire Safety Education:** Initiate video tapes and public education programs covering fire and life safety.
Coordination: Continue Mutual Aid Program (Police and Fire).	**Coordination:** Expand Mutual Aid Program (Police and Fire).
Emergency Operations: Update Emergency Plan annually.	**Emergency Operations:** Develop Emergency Operations Center at Civic Center.
Emergency Practice: Continue simulated emergency exercise annually. Use City Emergency Plan.	**Emergency Practice:** Expand simulated emergency exercise to include all City, hospital, school staffs. Expand City Emergency Plan.
Computer Operations: Continue staff training programs.	**Computer Operations:** Expand and complete computer system. Coordinate with other agencies.
Communications: Continue staff training programs regarding communication systems.	**Communications:** Purchase state of the art communication system designed to interface with all other agencies.
Seismic Safety: Continue requirements for seismic safety as per Uniform Building Code-1985 for new construction.	**Seismic Safety:** Adopt Uniform Building Codes as published. Fully utilize Construction Pro published by the California Seismic Sa Commission (83-05). Develop seismic safety criteria for existing buildings. Complete and implement seismic safety study and recommendations for existing masonry buildings, especially in the Village.
Seismic Education: Continue public education regarding seismic danger and emergency preparation.	**Seismic Education:** Distribute publications to businesses, schools and general public regarding 72-hour post-disaster independence period. Produce and distribute individual survey sheets for 30± most susceptible buildings.
Record Keeping: Continue record keeping for the City.	**Record Keeping:** Duplicate records on microfilm and store duplicates at a second site.
Financial Seismic Safety: Continue City financial reserve program.	**Financial Seismic Safety:** Investigate Seismic Safety Rehabilitation Loan Program.
Inspection of Bridges: City receives bridge inspection reports from Caltrans on a periodic basis. To date, Bridge St. bridge is under consideration for replacement.	**Inspection of Bridges, Overcrossings:** Press for 101 overcrossings on California STIP funding list for cables and structural integrity. Strengthen local bridges on truck routes.
Flood: Continue flood safety building inspection. Continue dam structure maintenance and inspection. Continue prohibition on building in Federal floodway (creeks).	**Flood:** Contract with Cal Poly for computer analysis of flood area and flood levels resulting from Lopez Dam failure. Require drainage in new development areas to prevent short-term flooding.
Hazardous Material: Continue staff training programs (Police and Fire).	**Hazardous Material:** Purchase protective clothing and material. Design second fire station.
Radiation Preparedness: Continue staff training.	**Radiation Preparedness:** Further coordination with City, school and hospital staffs.

This section shall be reviewed annually by the City Manager and the Police and Fire Chiefs. The entire Element shall be reviewed and updated in years ending in 0 and 5.

SAFETY AND SEISMIC SAFETY ELEMENT

List of Sources

Arroyo Grande
1974 General Plan, Seismic Element
1976 General Plan, Safety Element
1976 General Plan, Noise Element

San Luis Obispo County, Seismic Safety Element, General Plan, 1975

Arroyo Grande Police Department	Chief James Clark
Arroyo Grande Fire Department	Chief Doug Hamp
Arroyo Grande Building Department	Director John Richardson
Arroyo Grande Public Works Department	Director Paul Karp, Engineer Dwayne Chisam
Lucia Mar School District	Henry Wacthmann and staff
SLO County Engineering Department	Hal Wilcomson
SLO County Office of Emergency Services	Jeff Hamm
SLO County Planning Department	Norma Dengler

Arroyo Grande Zoning Ordinance, Articles 36 and 37
Bay Area Regional Earthquake Preparedness Project
"Big Quake. Safety Experts Fear State Isn't Ready" L.A. Times, 8-12-85
California Earthquake Response Plan, 1983
California Health and Safety Codes, Sections 25275-25290
California Law Enforcement Mutual Aid Plan, 1985

Developers Guide, Arroyo Grande Fire Department, 1985
Diablo Canyon Newsletter, 1986
Diablo Canyon Power Plant Emergency Response Plan Booklet, 1985-86
Disaster Operations, A Handbook for Local Governments, 1981

Earthquake Emergency Planning at Diablo Canyon
Earthquakes and Earthquake Faults of California
Fault-Rupture Hazard Zones in California: Alquist-Priolo Special Studies Zones Act
Flood Boundary and Floodway Maps, FEMA, 1984

Geographic Atlas of California, Division of Mines and Geology
Geologic Map Index, 1984, U.S. Geological Survey
Hazardous Material Incident Contingency Plan
Homeowner's Guide to Fire and Watershed Management
"Life on the Line" San Francisco Examiner, 10-11-85

Municipal Code, Section 9-3.507(1)(19)
Offshore Faults From Haskins and Griffiths
"Predicting Earthquakes, Long-term Forecasts" Christian Science Monitor, 1-10-85
Residential Sprinkler Systems, Arroyo Grande Fire Department, 1985
Seismic Safety Element, General Plan, Los Angeles, 1975
State of California Nuclear Power Plant Emergency Response Plan, 1975

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TECHNICAL APPENDIX 7.0

Appendix 7.1

Fire Department
General Information

The Arroyo Grande Fire Department is responsible for fire protection in the City. Staff consists of one paid professional Fire Chief and 40 volunteer officers and fire fighters. Headquarters are located in the new (1981) Fire Station at Station Way and Traffic Way.

Rolling stock inventory includes:

1 - 1000-GPM pumper
1 - 1250-GPM pumper
1 - 1500-GMP pumper
1 - Mini-attack vehicle
1 - Rescue vehicle

The Fire Department has a mutual aid agreement with the California Division of Forestry and other city Fire Departments. Using these reciprocal arrangements, agencies can share personnel and equipment during an emergency. Mutual aid accomplishes an increase in fire protection capabilities at minimal cost.

The Fire Department has emergency medical technicians at its disposal, and is well equipped for related rescue assignments. In 1985, the Fire Department responded to 198 alarms; of these, 20% involved structures. Water supplies and water hydrants are sufficient for the present development of the City; new hydrants are required of new development.

As development occurs in the North Hills, a second station will be needed to serve the North Hills and western sections of the City.

Source: Fire Chief Doug Hamp

Appendix 7.2

Summaries From A Homeowner's Guide to
Fire and Watershed Management at the
Chaparral/Urban Interface

The Chaparral Plant Community

Chaparral communities have adapted to summer drought, frequent fires, and steep unstable slopes.

Chaparral plants are able to recover after fire by sprouting and by fire-stimulated germination of seeds.

The flammability of chaparral vegetation depends on its moisture content, the ratio of dead-to-living fuel, and the amount of vegetation per unit area.

The stage of plant succession and the severity of a site affect the likelihood and intensity of a fire.

Watershed Management Considerations

Watershed management aims at maintaining a deep-rooted, dense cover of healthy plants.

Such a plant cover controls surface erosion and reduces slippage by anchoring the soil.

Deep-rooted plants pump water out of the soil, leaving it free to absorb winter rains.

Most postfire mudflow originates from debris accumulated in canyons by previous surface erosion, soil slips, and landslides.

Fire can accentuate the water repellency of soil.

Owning a Fire-safe Home

Legal brush clearance requirements: California Resource Code 4219 requires clearance of flammable vegetation for a minimum distance of 30 to 100 feet around any structure located in a fire hazardous area. The clearance distance is subject to local enforcement, and in extremely hazardous areas, local fire authorities may require clearance beyond 100 feet. However, the intent of the code is readily defeated if basic fire safety principles are not carried into home design and homesite selection.

Building design: The roof is the most vulnerable part of a home because it is exposed to airborne sparks. The wood shingle roof has been the single most important element in home losses during wildland fires. It is also a major source of airborne firebrands capable of igniting nearby structures. Studies of structural losses during wildfire in southern California have shown that with 100 feet of brush clearance, a home with a wooden roof has a 21 times greater chance of burning than a home with a nonwood roof. Although most fire insurance rates are approximately 25% higher for wood roofs than for nonwood roofs, this rate does not compensate for the true difference in risk.

Your pool as a water source: Pools can provide a convenient water source for use before or during a fire. Fire engines should be able to get within ten feet horizontally of the pool. If this is not possible, the pool should be equipped with a bottom drain and pipe system that terminates horizontally or below pool level in a 2-1/2-inch valved standpipe equipped with a fire hydrant with national standard thread. A floating pool pump or portable gasoline pump with a suction hose that can reach the bottom of the pool can assure a usable water source even when water pressure and electricity fail. You will also need a fire hose and nozzle.

Landscaping for Fire and Watershed Safety

Slope stabilization may be achieved by the use of deep-rooted plants in conjunction with slope engineering.

Fire management requires low-fuel or low-growing plants to reduce flame length and heat output.

As a compromise between watershed and fire safety, a combination of taller, deeper rooted plants should be interplanted with ground covers.

Maintenance for Fire and Watershed Safety

Maintenance of landscaping and structural additions around the home is essential to fire safety and watershed protection.

Maintenance needs are most critical within 30 feet of the home, but periodic fuel reduction and maintenance of drainage devices are required at greater distances from the home.

What To Do When Caught in a Wildfire

Stay calm - you are in control of the situation.

If you decide to stay with your home during a wildfire, evacuate all family members who are not essential to protecting the home.

Dress properly to shield yourself from the heat and flames.

Take steps to prepare your home for the approaching fire.

As the fire approaches, move inside and stay until it has passed.

Move outside, survey the situation, take action, and help neighbors.

If caught in the open, seek shelter where fuel is sparse.

Postfire Emergency Measures

Survey fire damage in relation to topography (the whole watershed) and structures.

Obtain expert advice immediately and coordinate quick action with other residents.

Use vegetative as well as mechanical emergency measures effectively, taking care to avoid possible damage to other properties.

Appendix 7.3

Citizen Safety

Prevention efforts of the Police Department should be the concern of all citizens. Crime reduction occurs when the community supports and cooperates with the Police Department.

Crime prevention programs are designed to create public awareness of crime and to encourage public participation in the elimination of criminal opportunity. These programs teach citizens preventative measures they can take to protect themselves and their property.

The way in which the City can be made reasonably safe is through preventative programs which involve citizens, thereby discouraging criminal action. This will be more important as the population increases and the crime rate rises.

The Police Department has analyzed the problem and initiated several programs to assist citizens in protecting themselves, their homes, businesses and private property. These programs are detailed in the text of the Safety and Seismic Safety Element, under Citizen Safety (IIB). Specific programs are available to neighborhood members, schools or service and community groups.

Source: Police Chief James Clark

Appendix 7.4

Seismic Glossary and Magnitude Scale Information

Active: Display evidence of movement within the last 11,000 years.

Aftershock: An earthquake which follows an earlier, and usually larger, shock.

Atenosphere: The molten interior of the earth.

Dip angle: The angle of a fault in relation to the surface (10 degrees from perpendicular, etc.).

Epicenter: The point on the earth surface directly above the hypocenter.

Fault: A fracture or zone of associated fractures in the earth, along which rocks on one side have moved in relation to those on the other side.

Fault valley: A valley created by quake action which uplifted adjacent land.

Fault trace: Where the vault is visible on the surface.

Fault zone: An area of related multiple faults, sometimes parallel, sometimes branching off from another.

Foreshock: A small tremor that precedes a larger quake.

Geomorphic: The form of the earth's surface.

Gouge: Created in faults by the grinding action of movement, gouge is the earth and rocks pulverized to a clay-like consistency.

Hypocenter: The determined center of an earthquake in the earth's crust.

Impounded water: Where fault-related dams of dense material in the earth impede downslope flow of underground water. Recognized by lusher growth more on one side than the other.

Intensity: A measure of the effect of an earthquake on persons and objects at a particular place.

Left lateral slip: Where land on the far side of a fault has moved to the left, in relation to that on the near side.

Lithosphere: The outer surface of the earth, including the plates on which it rests.

Love wave: A seismic wave caused by an earthquake. It is a surface wave with an average speed of 3 miles a second and has undulating periods.

Lurch cracks: Fractures or cracks, usually in sedimentary ground formations.

Magma: Molten rock.

Magnitude: A measure of the energy released at the epicenter of an earthquake.

Oblique slip: Combined vertical and lateral movement along two sides of a fault.

Plate Tectonics: The theory that all portions of the outer earth rest on huge plates which drift on the molten interior.

Primary wave: A seismic wave deep in the earth; it travels the fastest of the waves (5 miles a second), and is the first to be felt or recorded. Described as longitudinal and compressional.

Rayleigh wave: A surface wave, and much slower than a Love wave. It has an elliptical motion.

Reverse fault: See **thrust fault.**

Ridges: Can be formed in several ways: (1) Fractured earth on a hillside may erode away, with more resistant adjacent material left standing. (2) Rock has been forced upward from between two parallel faults. (3) A section of hillside or mountainside may be broken away and, due to subsequent quakes, move along the fault line. In some cases, this movement over a long period of time is quite extensive. The same movement is known to occur with rocks.

Rift zones: Areas whose geomorphic features have been created by local faulting and fracturing.

Right lateral slip: Where the opposite side of a fault has moved right in relation to the near side.

Saddle: Where a fault cuts across a ridge of hills or mountains, and erosion of crushed rocks has created a depression or vee.

Sag Pond: A depressed area that traps water run-off from higher adjacent ground. Many well-known lakes are sag ponds.

Scarp: A steep ridge or cliff adjacent to a fault line, generally formed by uplift.

Secondary wave: A seismic wave in the earth generated by an earthquake, which is the next fastest to the Primary wave. It is transverse to the fault line and is distortional, displacing particles at 90 degrees to the direction of travel. Speed is approximately 3 miles a second.

Seiche (Saysh): A wave or waves in confined water, such as ponds, lakes, bays, swimming pools or harbors, that is often but not always generated by earthquakes. Other causes are from weather disturbances.

Slip strike: Horizontal movement along a fault.

Sunken block (AKA: Graben): A fairly level area between two somewhat parallel faults, as well as the associated mountain ranges or hills that were uplifted by those faults.

Swarm: A series of small quakes occurring in the same approximate area in a limited time and obviously related.

Thrust faulting: When pressure at near 90 degrees to a fault results in land rise or uplift. The displaced material rides upward at an angle determined by the fault dip angle, and covers the material on the other side of the dip angle.

Trend: Direction of lay.

Troughs: The gullies between ridges; generally long and narrow.

Tsunami (Tsu'na'me): From the Japanese term for an earthquake-generated tidal wave. Sometimes caused by shallow submarine earthquakes, others by submarine landslides or volcanic eruptions.

Wave: A pattern of vibration in the earth caused by an earthquake.

Earthquakes generate waves of vibrations in the earth, much the same as a storm at sea causes waves. Just as seas have different wave patterns, seismic waves have distinctive actions. The Primary wave (P), traveling below the surface at a rate of approximately 5 miles a second, is usually the first to be felt or recorded on instruments. This is followed by the Secondary wave (S), also below the surface and traveling approximately 3 miles a second. It has approximately twice the period and amplitude of the P wave. The third wave, or Love wave, travels on the surface, has undulating periods, and a speed of approximately 2 miles a second. The Rayleigh wave is a surface wave (about 10 percent slower than the Love wave), and has an elliptical motion somewhat like a sound wave.

Magnitude Scale Information

The Richter Scale introduced a concept of magnitude measurement based on measurement of wave amplitudes/periods, and making allowances for distance. This system is in wide use today. The scale has a logarithmic base. Logarithms is an algebraic formula using factors from a table for calculations in which each increment is multiplied by a factor which is ten times larger than the previous factor.

Thus, an earthquake of magnitude 8.6 by this scale would not be twice as violent at one of 4.3, but ten thousand times worse. The energy released by the larger quake would be close to one million times as much as that for the smaller.

Following are some comparisons between the two systems of measurement:

Richter Magnitude Scale	Square miles in area affected	Equivalent to tons of TNT
3.0-3.9	750	
4.0-4.9	3,000	
5.0-5.9	15,000	1,000
6.0-6.9	50,000	10,000
7.0-7.9	200,000	100,000
8.0-8.9	800,000	1,000,000

Source: Earthquakes and Earthquake Faults of California

Appendix 7.5

California Earthquake Faults

California has its faults and the County of San Luis Obispo has its share, too. There are thousands of seismic faults in the state, but the San Andreas remains the dominant one.

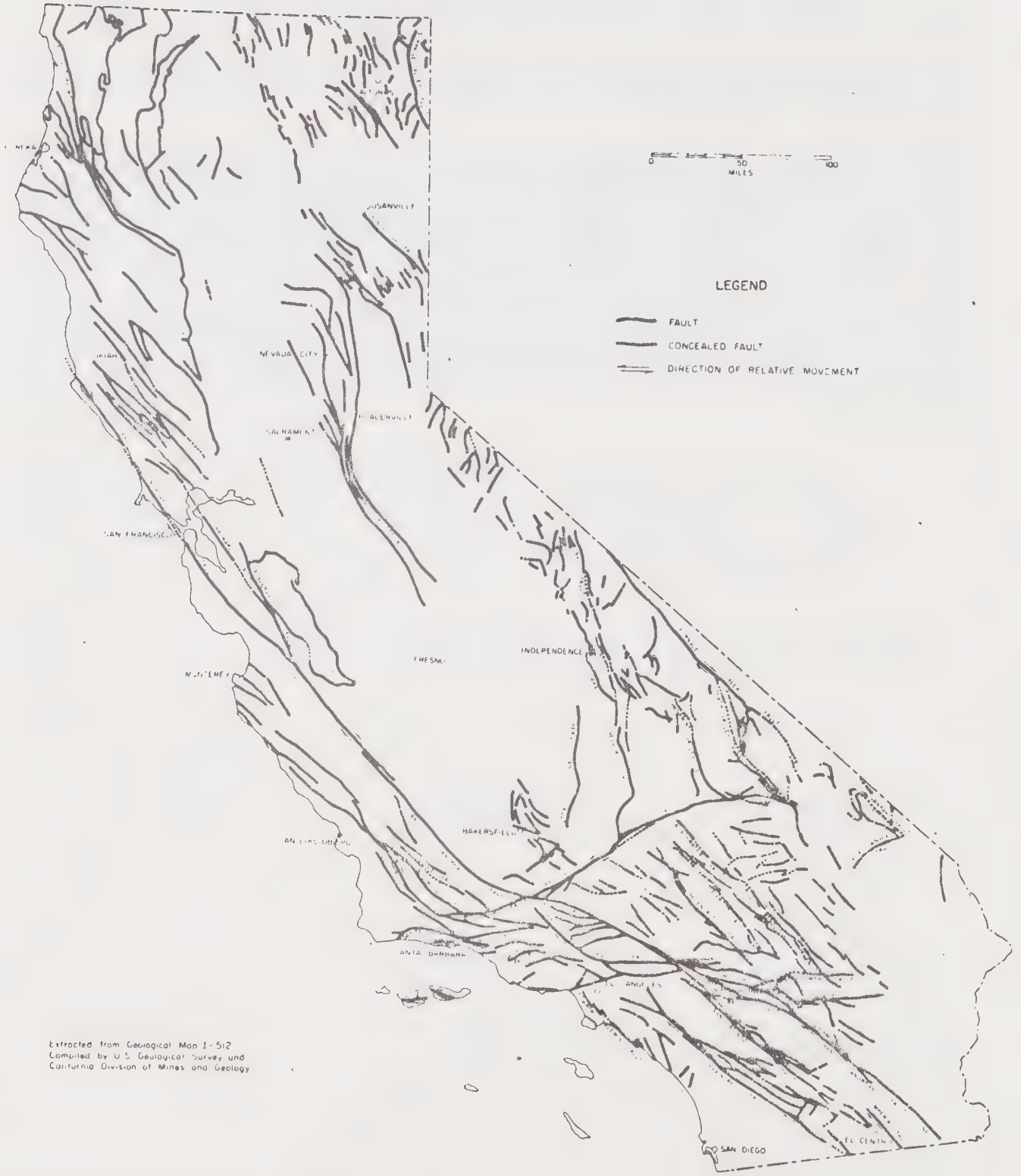
The San Andreas fault is less than 40 miles northeast of Arroyo Grande. Some people think of the San Andreas as an unseen, underground, usually silent seismic river. It is more than ten miles deep into the earth and varies in width from a few hundred yards to a mile. It crosses 80 miles of San Luis Obispo County and 700 miles of the state, generally traveling in a northwest/southeast direction.

The characteristics of a seismic fault area (a rift zone) are: long, straight valleys such as the Salinas Valley and the San Benito Valley; long ridge lines such as the Santa Lucia Range; a series of sag ponds, scarps, higher water table level, offset streams which bend angularly to resume flow after a quake such as those of the Carrizo Plains.

Source: "Life on the Line" by Tom Chaffin

Appendix 7.5

California Earthquake Faults



Source: United States Geological Survey

Appendix 7.6

Alquist-Priolo Act
Special Studies Zones Act

Relation to the General Plan
The Alquist-Priolo Act states that its purpose is to provide for "the adoption and administration of zoning laws, ordinances, rules, and regulations by cities and counties in implementation of the general plan..." (Public Resources Code Section 2621.5). The Act implies that the program for special studies zones must be incorporated into the general plan as well as carried out through zoning laws, ordinances, rules, and regulations. This implication is made explicit by the State Board of Mining and Geology's regulations, which have the force of law:

> Implementation of the Alquist-Priolo Special Studies Zones Act by affected cities and counties fulfills only a portion of the requirement for these counties and cities to prepare seismic safety and safety elements of their general plans, pursuant to Sections 65302(f) and 65302.1 of the Government Code. The special studies zones, together with these policies and criteria, should be incorporated into the local seismic safety and safety elements of the general plan.
>
> (Title 14, California Administrative Code Section 3600)

When the State Geologist formally designates a special studies zone, the affected cities and counties must amend their general plans to include policies, plan proposals, and standards consistent with the Alquist-Priolo Act. As with other planning issues, local officials should address the special studies zones program at three levels; data and analysis, policy, and implementation.

Data and Analysis: Within 90 days of final review of a special studies zone map by the Board, the State Geologist must send copies to affected cities and counties. The information on the maps, including the approximate location of the faults and the boundaries of the special studies zones, should be transferred to the hazard maps already included in the general plan.

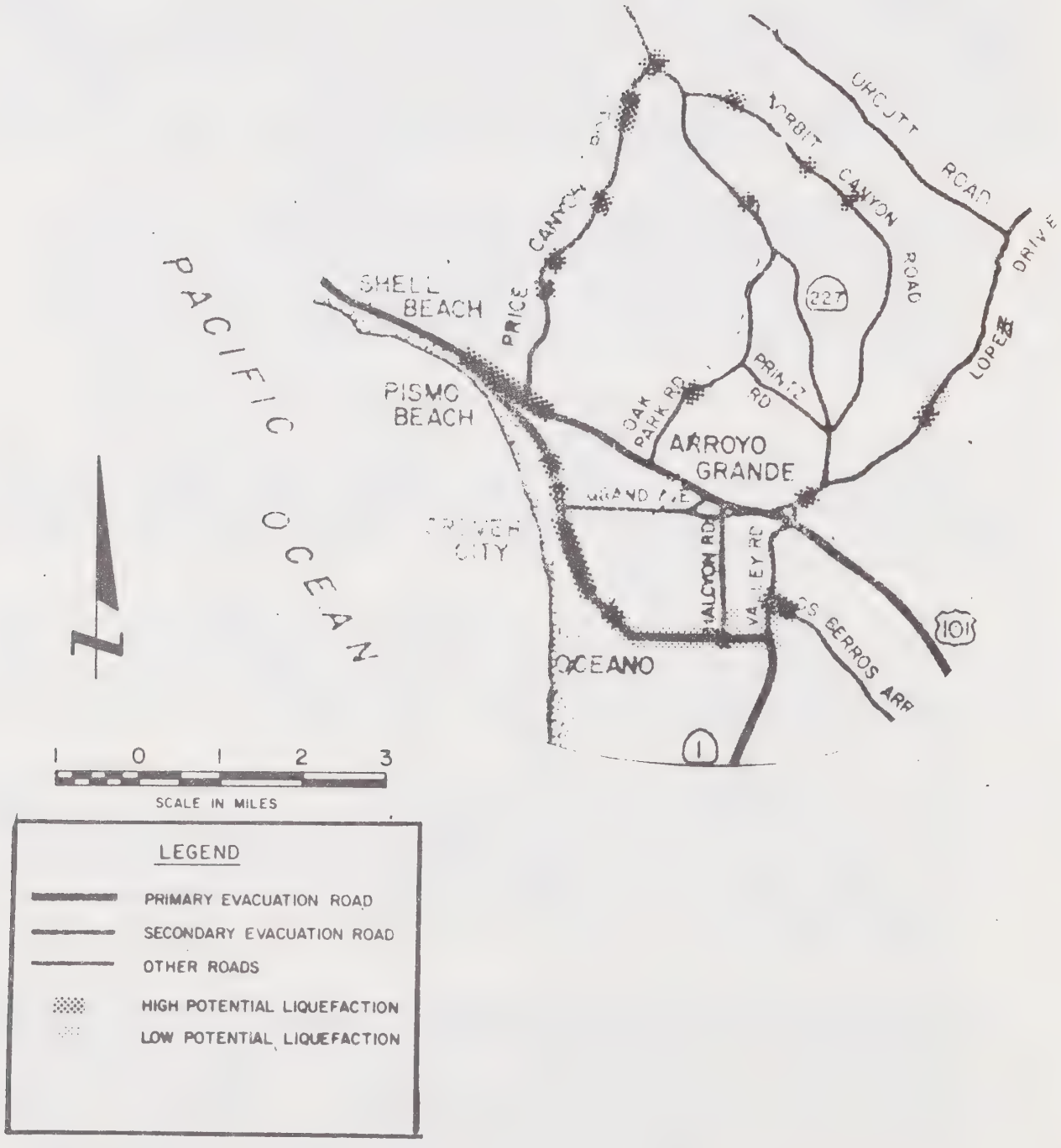
Policy: The policies, plan proposals, and standards concerning seismic hazards should be amended to include the policies and criteria established by the Board. Specifically, the general plan should include a basic statement of policy drawn from the Alquist-Priolo Act that no building within a special studies zone will be permitted to be placed across an active fault. If it wishes, however, a city or county can establish policies and criteria more restrictive than those of the State Mining and Geology Board.

Implementation Measures: The general plan should outline the procedures the city or county will use in implementing the policies for development within the special studies zones, including procedures for the submission and review of geologic reports and the waiver of the requirement for a geologic report. The Division of Mines and Geology's Special Publication 42 contains "Guidelines for Evaluating the Hazard of Surface Rupture," "Suggested Outline for Geologic Reports on Faults," and other information useful to local governments in implementing the Alquist-Priolo Act. Local governments can also contact the Division for advice on preparing a local ordinance for implementing the Alquist-Priolo Act.

San Luis Obispo County is a Special Studies Zones Area, but Arroyo Grande is not, at this time. If the State Geologist declares the City a Special Studies Zones Area, the above sections will apply.

Appendix 7.7

Subsidence of Roads



Source: Earthquake Emergency Planning at Diablo Canyon, 1981

Appendix 7.8

Building Site Soil Limitations

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
102---------- Arnold	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
103---------- Arnold	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
108---------- Briones	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
115---------- Chamise	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: small stones, droughty, slope.
116---------- Chamise	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
---------- Chamise	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Moderate: small stones, droughty.
125---------- Corralitos Variant	Severe: cutbanks cave, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Moderate: droughty, floods.
159---------- Los Osos	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
169---------- Marimel	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Moderate: floods.
184---------- Oceano	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty, too sandy.
185---------- Oceano	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
186---------- Perkins	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Slight.
187, 188---------- Perkins	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
189---------- Pismo	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
---------- ismo	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rock outcrop.						

-Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Pismo	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: thin layer.
203, Santa Lucia	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
206, Santa Lucia	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: small stones.
207, Santa Lucia	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
219, Tujunga	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: droughty, floods.
220, Tujunga	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
225, 227, Zaca	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

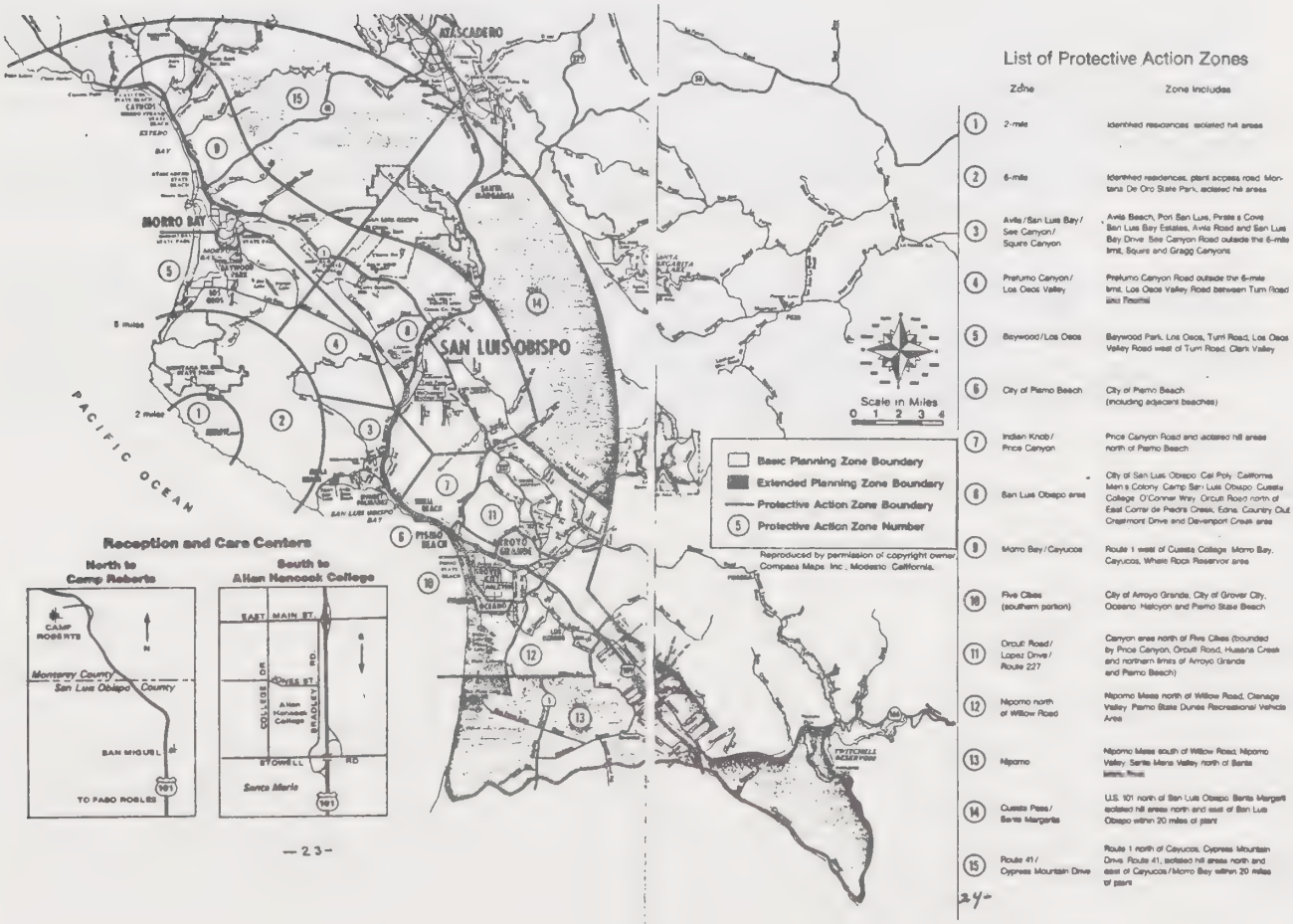
United States Department of Agriculture

Soil Conservation Service

In cooperation with University of California Agricultural Experiment Station

Appendix 7.9

Diablo Canyon Power Plant
Emergency Response Plan Booklet



List of Protective Action Zones

Zone		Zone Includes
1	2-mile	Identified residences, isolated hill areas
2	5-mile	Identified residences, plant access road, Montana De Oro State Park, isolated hill areas
3	Avila/San Luis Bay/ See Canyon/ Squire Canyon	Avila Beach, Port San Luis, Pirate's Cove, San Luis Bay Estates, Avila Road and San Luis Bay Drive, See Canyon Road outside the 5-mile limit, Squire and Gragg Canyons
4	Prefumo Canyon/ Los Osos Valley	Prefumo Canyon Road outside the 5-mile limit, Los Osos Valley Road between Turri Road and Foothill
5	Baywood/Los Osos	Baywood Park, Los Osos, Turri Road, Los Osos Valley Road west of Turri Road, Clark Valley
6	City of Pismo Beach	City of Pismo Beach (including adjacent beaches)
7	Indian Knob/ Price Canyon	Price Canyon Road and isolated hill areas north of Pismo Beach
8	San Luis Obispo area	City of San Luis Obispo, Cal Poly, California Men's Colony, Camp San Luis Obispo, Cuesta College, O'Connor Way, Orcutt Road north of East Corral de Piedra Creek, Edna Country Club, Creekmont Drive and Davenport Creek area
9	Morro Bay/Cayucos	Route 1 west of Cuesta College, Morro Bay, Cayucos, Whale Rock Reservoir area
10	Five Cities (southern portion)	City of Arroyo Grande, City of Grover City, Oceano, Halcyon and Pismo State Beach
11	Orcutt Road/ Lopez Drive/ Route 227	Canyon area north of Five Cities (bounded by Price Canyon, Orcutt Road, Husana Creek and northern limits of Arroyo Grande and Pismo Beach)
12	Nipomo north of Willow Road	Nipomo Mesa north of Willow Road, Oceano Valley, Pismo State Dunes Recreational Vehicle Area
13	Nipomo	Nipomo Mesa south of Willow Road, Nipomo Valley, Santa Maria Valley north of Santa Maria River
14	Cuesta Pass/ Santa Margarita	U.S. 101 north of San Luis Obispo, Santa Margarita isolated hill areas north and east of San Luis Obispo within 20 miles of plant
15	Route 41/ Cypress Mountain Drive	Route 1 north of Cayucos, Cypress Mountain Drive, Route 41, isolated hill areas north and east of Cayucos/Morro Bay within 20 miles of plant

Appendix 7.10

Emergency Response Plan
Lucia Mar Unified School District

Lucia Mar Unified School District stretches from Shell Beach to the Santa Maria River on the south to the Kern County line on the east. Safety is high on the school district's priority lists - safety for each student and staff member.

In 1982, Lucia Mar was the first to adopt a plan specifically designed for an emergency at Diablo Canyon Nuclear Power Plant. The plan considers many factors, including weather, transportation, building capacity and structure, etc.

The present Lucia Mar Emergency Plan is comprehensive; it considers various disasters and spells out proceducres for crises management. Considered are dam collapse, flooding, earthquake, fire and other potential disasters.

Several schools are within the limits of dam inundation (Lopez Dam), including Arroyo Grande High School. Henry Wachtmann, responsible for the plan, declares, "If the dam were to collapse, we'd have 12 minutes in which to act - we have to be prepared."

The school district considers itself well prepared for the unexpected. All staff members receive emergency training, children are drilled, also.

Source: Diablo Canyon Newsletter, Jan. 1986

Appendix 7.11

Pipeline Locations

Utilities transverse the City, and these underground lines are a potential hazard to the City. Failure of oil, natural gas, gasoline and/or water pipelines may be caused by seismic activity, line failure, faulty pipes or connections, puncture or related factors.

Three pipelines carrying gasoline products from south of the City enter Arroyo Grande on Halcyon Road, Valley Road and Bambi. The two eastern lines (Valley and Bambi) join on county lands south of the high school and go directly west to Creekside Drive, then connect with the major pipeline on Halcyon Road. This line continues north to Grand Avenue, then west on Grand to Oak Park Boulevard. The pipeline follows the Oak Park Boulevard line directly northwest from Grand to one-quarter mile north of Highway 101. A right angle turn east brings the pipeline to Oak Park Boulevard opposite Casa Grande Motel. The pipeline follows the Oak Park Boulevard route north into the county.

Two natural gas pipelines cross Arroyo Grande. One parallels Halcyon from the south City limits to El Camino Real, west on El Camino Real to Brisco, then Brisco to West Branch Street. The line goes southeast on West Branch Street for a block, runs under St. Patrick's Elementary School northeast to Vista Los Altos, where a 70-degree angle changes the direction northwest to James Way, then north to Vista Drive (east of Arabian Circle) and north out of the City, crossing Noyes Road.

The other natural gas pipeline enters near Los Berros Road at Tiger Tail Drive and turns north. It parallels Valley Road, approximately one block east. The pipeline then follows Valley Road and the western edge of the high school. The pipeline continues in a straight line to Barnette Street and meets El Camino Real. The pipeline parallels El Camino to a spot just west of Halcyon. It crosses under Highway 101 to West Branch Street and goes west, paralleling West Branch Street. At Oak Park Boulevard, the pipeline turns north to James Way. The pipeline then turns west on James Way into Pismo Beach.

The Lopez water line follows Huasna Road from the east City limits to Highway 227, remaining south of Huasna. It turns north on 227 to Le Point Street, then west, paralleling Le Point to the Arroyo Grande Women's Club and Community Center. The Lopez line crosses the ravine and parallels West Branch Street to Brisco Road and crosses under Highway 101 to El Camino Real, which it then parallels to Oak Park Boulevard.

Appendix 7.12

Resolution Adopting the Safety and
Seismic Safety Element

RESOLUTION NO. 1949

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF ARROYO GRANDE ADOPTING THE SAFETY AND SEISMIC SAFETY ELEMENT OF THE GENERAL PLAN.

WHEREAS, Section 65302 (i) and Section 65302 (f) of the California Government Code directs all cities and counties to prepare a Safety and Seismic Safety Element; and

WHEREAS, the City has determined that it is appropriate and necessary to update and revise previous safety and seismic safety plans adopted by the City; and

WHEREAS, the Planning Commission and City Council have held public hearings on a new Safety and Seismic Safety Element in accordance with the California Government Code and General Plan Amendment regulations of the City; and

WHEREAS, the Planning Commission and City Council have considered public testimony and technical information prepared by staff covering goals, policies, and programs and including analysis of the City's emergency preparedness program and a program implementation; and

WHEREAS, the City Council intends to re-examine the Safety and Seismic Safety Element periodically to evaluate the effects of programs and to consider new information.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Arroyo Grande as follows:

1. The Safety and Seismic Safety Element of the City of Arroyo Grande General Plan, as required by California Government Code Sections 65302 (i) and (f) is adopted. The text of said adopted element is available in the City Hall Planning Department.

2. The Planning Department shall publish and make available to the public said element and shall distribute copies to appropriate members of City government, to the California Office of Planning and Research, other appropriate agencies and local libraries;

3. The adoption of this Element shall take effect thirty (30) days from the date of adoption of this Resolution.

On motion of Council Member Gallagher, seconded by Council Member Johnson, and on the following roll call vote, to wit:

AYES: Mayor Smith and Council Members Gallagher, Johnson, Moots and Porter
NOES: None
ABSENT: None

the foregoing Resolution was passed and adopted this 22nd day of April 1986.

RESOLUTION NO. 86-1082

A RESOLUTION OF THE PLANNING COMMISSION OF THE CITY OF ARROYO GRANDE RECOMMENDING TO THE CITY COUNCIL ADOPTION OF THE SAFETY AND SEISMIC SAFETY ELEMENT OF THE GENERAL PLAN.

WHEREAS, the City of Arroyo Grande has undertaken to prepare the Safety and Seismic Safety Element in consideration of the community's safety, environmental and social factors and community goals as set forth in the General Plan; and

WHEREAS, the Planning Commission has reviewed and considered the Safety and Seismic Safety Element at their regular meetings of March 18, 1986 and April 1, 1986, and did solicit public comment upon such proposed Element at a duly noticed Public Hearing.

NOW, THEREFORE, BE IT RESOLVED that the Planning Commission of the City of Arroyo Grande does hereby recommend to the City Council adoption of the Safety and Seismic Safety Element of the General Plan.

On motion by Commissioner Soto, seconded by Commissioner Moore, and by the following roll call vote, to wit:

AYES: Commissioners Soto, Moore, Carr, Olsen, Flores, Boggess and Chairman Gerrish
NOES: None
ABSENT: None

the foregoing Resolution was adopted this 1st day of April 1986.

ATTEST: Pearl L. Chinnery
Secretary

Chairman